Growth of 2-D KTP photonic crystals for efficient second order nonlinear optical processes

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In recent years it became clear the relevance of photonic crystals (PC's) when considering a nonlinear interaction. In fact, it has been shown in many cases that the structuring of the material results in a clear enhancement of the nonlinear interaction[1]. However, there are not too many structuring technologies that can be applied successfully to materials that exhibit very good physical properties for the nonlinear generation of visible light. One of these is KTP, an inorganic material with a high nonlinearity, large electrooptical coefficients, and very good transparency in the near infrared and visible range.

In this paper, we propose a novel technique to grow 2-dimensional KTP PC's by liquid phase epitaxy employing a 2D ordered macroporous Si matrix as a mask. The Si mask can be removed by selective chemical etching, leading to a photonic structure of KTP and air. Such 2-D PC exhibits a lattice parameter in the micrometer range, columns about 70 μm in height, and high index contrast suitable for nonlinear optical applications.

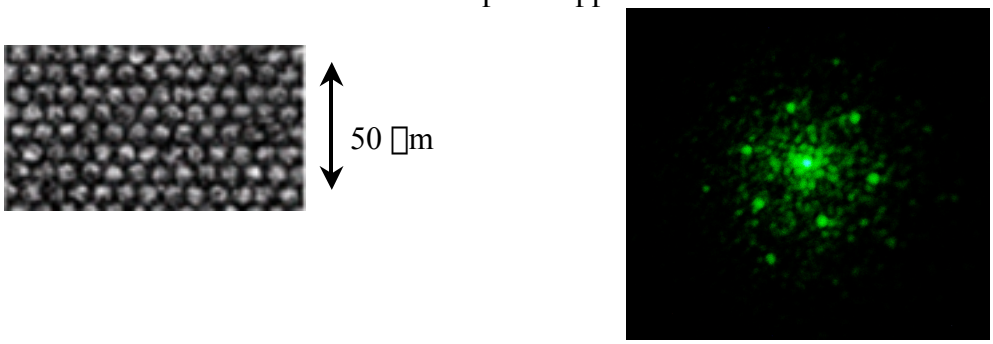

Fig.1: SEM picture of the sample before etching the Si mask (left). The cracks visible on the KTP columns are a consequence of the polishing process. Diffraction pattern from the 2-D PC when the incident beam is tuned at 527nm (right).

By pumping the sample from the top surface with a pulsed Nd-glass laser, we study the nonlinear reflection and diffraction properties of the sample as a function of the angle of incidence and the azimuthal angle to show the effects of the photonic lattice.

[1] A. R. Cowan and J. F. Young, *Phys. Rev. B*, **65**, 085106 (2002)